ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Special Issue , August 2019

International Conference on Recent Advances in Science, Engineering, Technology and Management at Sree Vahini Institute of Science and Technology-Tiruvuru, Krishna Dist, A.P

A Case Study on Estimation and Costing of Multi-Storey Building

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ABSTRACT:Multi storey building construction (APARTMENT BUILDING) detailed estimation methodologies, including cost estimating, hard bid, negotiated price, traditional, management contracting, construction management-at-risk, design and design build-bridging. Multi storey building is one that is dedicated to commercial activities. In our project we deal with estimate and costing of Multi story apartment building with the all requirements with in the budget of clients The estimator can modify some specifications in the building design depends upon the factors like site conditions, budget of the customer, requirements of the material availability and other. In our project we estimate and costing of the (G+5) apartment building with step by step procedure and calculations in volumetric analysis and quantity surveying. In our project we were using the standard schedule rate sheet (SSR) 2013 for volumetric analysis and quantity surveying.

KEY WORDS: Estimation, construction management-at-risk, design build-bridging, volumetric analysis and quantity surveying

I. INTRODUCTION

ESTIMATION: Estimation is the scientific way of working out the approximate cost of an engineering project before execution of the work. It is totally different from calculation of the exact cost after completion of the project. Estimation requires a thorough Knowledge of the construction procedures and cost of materials &labour in addition to the skill, experience, foresight and good judgment. An estimate of the cost of a construction job is the probable cost of that job as computed from plans and specifications. For a good estimate the, actual cost of the proposed work after completion should not differ by more than 5 to 10 % from its approximate cost estimate, provided there are no unusual, unforeseen circumstances. Estimation is help to work out the approximate cost of the project in order to decide its feasibility with respect to the cost and to ensure the financial resources, it the proposal is approved. Requirements of controlled materials, such as cement and steel can be estimated for making applications to the controlling authorities. Estimation is used for framing the tenders for the works and to check contractor's work during and after the execution for the purpose of making payments to the contractor. From quantities of different items of work calculated in detailed estimation, resources are allocated to different activities of the project and ultimately their durations and whole planning and scheduling of the project is carried out. Site conditions are affected by the cost estimation so that all are site conditions are considered (i.e. transportation, water quality, pollutions and etc.). Accuracy in estimate is very important, if estimate is exceeded it becomes a very difficult problem for engineers to explain, to account for and the additional money. Inaccuracy in preparing estimate, omission of items, changes in designs, improper rates, etc.

A.TYPES OF ESTIMATIONS: -

Estimations are mainly classified into two types that are

1. ROUGH COST ESTIMATION
2. DETAILED ESTIMATION.
3.

A.1 ROUGH COST ESTMATION

Estimation of cost before construction from plans or architectural drawings of the project scheme, when even detailed or structural design has not been carried out, is called Rough cost estimate. These estimates are used for obtaining Administrative Approval from the concerning Authorities. Sometimes, on the basis of rough cost estimates,

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a proposal may be dropped altogether. Unit cost is worked out for projects similar to the project under consideration carried out recently in nearly the same site conditions. Unit cost means cost of execution of a unit quantity of thework. To find rough cost of any project, this worked average unit cost is multiplied with total quantity of the present work in the same units.

For example, in case of a building, plinth area (sq. ft.) of the proposed building is worked out, which is then multiplied by the cost per unit area (Rest. /ft2) of similar building actually constructed in the near past in nearly the same site conditions, to find out the rough cost estimate of the building.

This cost is sometimes adjusted by the average percentage rise in the cost of materials, wages and the use of machines.

The rough cost estimate may be prepared on the following basis for different types of projects:

a) Cost per square foot of covered area (plinth area) is the most commonly adopted criterion for preparing rough cost estimate for most of the multi storied buildings.
b) for public buildings, cost per person (cost per capita) is used. For example

Students hostel————————-—cost per student
Hospitals————————————Cost per bed
Hotel————————————Cost per Guest

c) Cost per cubic foot is particularly suitable for commercial offices, shopping centres, and factory buildings, etc.
d) for water tank/reservoir, cost may be worked out on the basis of capacity in gallons of water stored.
e) for roads and railways, cost may be found out per mile/kilometre of length.
f) for streets, cost may be per hundred feet/meters of length.
g) In case of bridges, cost per foot/meter of clear span may be calculated.

A.2 DETAILED ESTIMATION: -

Detailed estimate is an accurate estimate and consists of working out the quantities of each item of works, and working the cost. The dimensions, length, breadth and height of each item are taken out correctly from drawing and quantity of each item are calculated, and abstracting and billing are done. Detailed estimates are prepared by carefully and separately calculating in detail the costs of various items of the work thatconstitute the whole project from the detailed working drawings after the design has been finalized. The mistakes, if any, in the rough cost estimate are eliminated in the detailed estimate. Detailed estimates are submitted to the competent authorities for obtaining technical sanction.

The detailed estimate is prepared in two stages

(a) The details of measurement and calculation of quantities
(b) Abstract of estimated cost

(a)The Details of Measurement and Calculation of Quantities

The detail of measurement of each item of the work taken out correctly from plan and drawing and quantities under each item are completed or calculated in a tabular form named as details of measurement form (See Table No:1)

Item no	Description	Numbers	Length	Width	quantity

(b)Abstract of estimated cost

The cost of each team of work is calculated in a tabular form the quantities already computed and total cost is worked out in an Abstract of estimate form (see Table no 2). The rates of different items of work are taken as per schedule rates or current workable rates or analysed rates for finished item of work. A percentage usually 3% of the estimated cost is added to allow for contingencies for miscellaneous petty items which do not come under any classified head of items of work and a percentage of about 2% is provided for work charged establishment. The Grand total thus obtained gives the estimated cost of work.

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The detailed estimate is usually prepared work-wise, under each sub-work as main building, servant quarters, garage, boundary walls etc.
The detailed estimate is accompanied with: -
(a) Report.
(b) General specifications.
(c) Detailed specifications.
(d) Drawings: - plan, elevation, sectional elevations, Detailed drawings, Site plan or Layout plan or Index plan etc.
(d) Calculation and designs: - Designs of foundation, beam, slab, lintel, design of channel in case of irrigation channel, design of thickens of metal crust in case of road etc.
(f) Analysis of rates, if rates are not as per schedule of rates or for non-scheduled items.

Detailed Estimate is prepared for technical sanction of the competent authority, for arranging contract and for the execution of work

If in the 'Abstracts of Estimate' form the columns of rates and amounts are left blank (to be filled by contractor) it is then known as bill of quantity.

Item no	Description	quantity	Unit	Rate	Amount

Detailed estimates are divided into following types it based up on the purpose of estimation:-
a) Contractor's estimate.
b) Engineer's estimate.
c) Progress estimate.

II. LITERATURE REVIEW

Murat Gunduza et.al (2015) have studied an early costestimation model for hydroelectric power plant projects.The main indicators considered and studied in this paperare the amount of energy generated in a hydro electricpower plant and the cost of investment and there bydecide whether a project investment is feasible or not.Cost of the project is calculated by detailed hydrologicalstudy, site investigation, good basin planning,geotechnical survey and various tests of the soils.Multiple regression method and artificial neural networkanalysis are taken for the validation. The models aredeveloped by the data collected from forty-nine hydroelectric power plant projects and five projects are used for
the validation of the models. Comparisons of validationresults revealed that the regression model had a 9.94%, and neural network model had 5.04% prediction accuracy. In thispaper the neural network shows more prediction accuracy than the regression analysis

In Estimating and Costing in Civil Engineering (Theory andpractice including specification and valuation), B.N Dutta hasfocused on various methods of estimating and costing ofquantities. It emphasizes on the calculations of quantities ofmaterials, tools, equipment, labours etc. and cost associatedwith them. It consists of numerous examples of estimation ofbuildings, RCC works, culverts, bridges, etc. Method ofpreparing preliminary estimates, analysis of rates,specification, methods of measurements have been dealt indetail with illustration. Many technical data have been included.

In Design and Estimation of a reinforced building: A CaseStudy (IOSR Journal of Mechanical and Civil Engineering), thecost of various structures of the administrative block of thebuilding are worked out and the design part ids done with thehelp of IS Code 457:2000.

III. METHODS OF DETAILED ESTIMATION

The mainly used for detailed estimations are two types that are
(a) Separate or individual wall method
(b) Centre line method

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COSTING: -

The disciplines of 'cost engineering' can be considered to encompass a wide range of costrelatedaspects of engineering and programmer management, but in particular cost estimating, cost analysis/cost assessment, design-to-cost, schedule analysis/planning and risk assessment. These are fundamental tasks which may be undertaken by different groups in different organizations, but the term cost engineering implies that they are undertaken throughout the project life-cycle by trained professional utilizing appropriate techniques, cost models, tools and databases in a rigorous way, and applying expert judgment with due regard to the specific circumstances of the activity and the information available. In most instances, the output of a cost engineering exercise is notated in itself but rather an input to a decision-making process.

Classification of Cost: -

The cost is classified as the mainly three types that as followed

1. Direct Cost
    a. Labor Cost
    b. Direct Labor
    c. Indirect Labor
    d. Material Cost
    e. Equipment Cost
2. Indirect Cost
3. Markup

IV. ANALYSIS OF MULTI-STOREY BUILDINGS

The tallness of a building is relative and cannot be defined in absolute terms either in relation to height or the number of stories. But, from a structural engineer's point of view the tall building or multistoried building can be defined as one that, by virtue of its height, is affected by lateral forces due to wind or earthquake or both to an extent that they play an important role in the structural design. Tall structures have fascinated an kind from the beginning of civilization. The Egyptian Pyramids, one among the seven wonders of world, constructed in 2600 B.C. are among such ancient tall structures. Such structures were constructed for defense and to show pride of the population in their civilization. The growth in modern multistoried building construction, which began inflate nineteenth century, is intended largely for commercial and residential purposes. The development of the high-rise building has followed the growth of the city closely. The process of urbanization that started with the age of industrialization is still in progress in developing countries like India. Industrialization causes migration of people to urban centers where job opportunities are significant.

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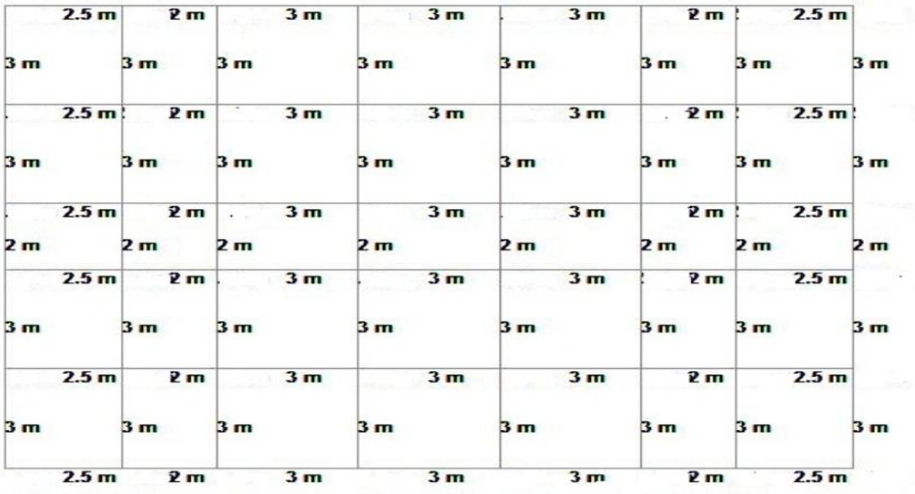
BUILDING PLAN (Case Study)



DETAILED ESTIMATION TABLER FORM

NO	Description	No	Length	Breadth	Height	Quantity	Total Quantity	Remarks
1	EARTH WORK EXCAVATION -FOOTINGS WALLS -LONG WALL -SHORT WALL	48 6 8	2.8 18 14	2.8 18 14	2.8 18 14	564.5 97.2 100.8	564.5+97.2 + 100.8= 762.5	
2	SAND FILLING -FOOTINGS WALLS -LONG WALL -SHORT WALL	48 6 8	2.8 18 14	2.8 18 14	 0.05 0.05 0.05	18.8 3.3 3.4	 3.4+3.3+1 8.8= 25.5	
3	PLAIN CEMENT CONCRETE -FOOTINGS WALLS -LONG WALL -SHORT WALL	48 6 8 1	2.8 18 14 18	2.8 0.6 0.6 14	0.15 0.15 0.15 0.15	*56.45* *9.72* *10.08* *37.8*	56.45+9.72 + 10.08+37.8 = 114.5	
4	CRS MASSONRY WALL -LONG WALL -SHORT WALL	6 8	18 14	0.6 0.6	1.5 1.5	97.2 100.8	97.2+ 100.8= 198	
5	RAIN FORCE CEMENT CONCRETE -FOOTINGS -PLINTH BEAM BELOW COLUMN	48 48 6	2.8 0.45 18	2.8 0.3 0.3	0.5 1 0.45	188.16 6.48 14.58	0.12+15.12 + 14.58+19.4 4 +15.12+ 14.58+6.48	

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	PLINTH BEAM -LONG BEAM -SHORT BEAM -PLINTH BEAM ABOVE COLUMN SLAB BEAM -LONG BEAM -SHORT BEAM -SLAB	8 46 8 1 1	14 0.4 14 18 5	0.3 0.3 0.45 0.45 0.15	0.45 3 0.45 0.45 0.1	15.12 14.58 15.12 37.8 9.44	+ 188.16= 311.4	
6	BRICK WORK -LONG WALLS -SHORT WALLS DEDUCTIONS -DOORS -WINDOWS	6 8 24 24	18 14 1.0 0.6	0.23 0.23 0.23 0.23	3 3 2.1 0.3	74.52 711.59 0.994 7.28	74.52+77.28- 11.59- 0.994= 139.216	
7	PLASTER ING	2	139.3			278.6	278.6	
8	DOORS	24	1	0.23	0.3	0.994	11.59	
9	WINDOWS	24	0.6	0.23		252	0.994	
10	FLOORING FINISH	1	18	14		194.56	252	
11	PAINTING	2	139.3				213.54	

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ROUGH ESTIMATION TABLAR FORM

Sr.no	Description of Item	Unit	Quantity	Rate	Cost	Remarks
1	EARTH WORK EXCAVATION	M3	762.5	114.91	87618.9	
2	SAND FILLING	M3	25.5	584.82	14912.9	
3	PLANE CEMENT CONCRETE	M3	114.5	3932.64	448518.17	
4	CRS MASSONRY WALL	M3	198	3401.63	673522.74	
5	RAINFORCE CEMENT CONCRETE	M3	311.4	9420.74	2933618.436	
6	BRICK WORK	M3	139.27	3769.45	444767.76	
7	PLASTERING	M2	278.54	214.43	59727.332	
8	DOORS	M2	24	2500	60000	
9	WINDOWS	M2	24	2200	52800	
10	FLOORING FINISH	M2	252	2200	554400	
11	PAINTING	M2	194.56	122.54	34132.292	
12	ELECTRICAL WORK	M	-	_	100000	
13	PLUMBING	M	-	_	50000	

V. CONCLUSIONS

We can conclude that there is Multi storey building (Apartment building) practical work done. As the scope of understanding will be much more when practical work is done. As we get more knowledge in such a situation where we have great experience doing the practical work.

Knowing the quantities, we have estimated for the building depending upon the STANDARD SCHEDULE RATE 2013. In this project we have estimate the all the major items of works (Earth work excavation, sand filling footings and columns, beams, slab total RCC Quantities and brick work Quantities all detail Quantities and Estimations… etc.) With in the client's budget with all requirements

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